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(54) Title: CARRIER TRAY FOR INTEGRATED CIRCUITS SUCH AS MICROPROCESSORS

(57) Abstract: Carrier trays comprise a synthetic resin composition containing inorganic fillers and having a low electrical resistivity. The resin is a thermosetting resin and the surface resistivity is low due to the presence of electrically conducting particles or fibres within the cured resin. Preferably the resin is an unsaturated polyester resin which is hardened or cured by the presence of an organic peroxide and which contains a polymerisation inhibitor inactivated by heat. The inorganic filler may be glass fibre, glass powder and/or calcium carbonate and the electrically conducting particles or fibres include one or more of carbon fibres, carbon black, metal fibres and metal coated fibres, such as glass and/or polymer fibres coated with a thin metal layer by vacuum deposition, electroless plating or other known techniques, and comprise from 2.5 to 7 percent by weight of the cured composition. The surface resistivity of the trays is less that 1 megohm per square, preferably less than 500 kilohms per square. A method of making the carrier trays comprises mixing into a thermosetting resin containing inorganic fillers electrically conducting particles or fibres until they are uniformly distributed within the resin and filler composition, placing the mixture in a mould in the form of the tray and thereafter heating the mould under pressure until such time as the thermosetting mixture has set and thereafter removing the tray so formed from the mould.

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CARRIER TRAY FOR INTEGRATED CIRCUITS SUCH AS MICROPROCESSORS

This invention relates to carrier trays for use in the manufacture, handling and shipping of semiconductor integrated circuits.

In the manufacture of complex integrated circuits, such as microprocessors, the individual circuit elements, after deposition of the necessary circuit wiring and elements on a germanium, silicon or similar insulating substrate, are placed on trays. As the individual circuits will have been cut from a comparatively large area substrate they are commonly referred to as "chips". The size of the trays usually conforms to a national standard, such as the Japanese national standard, JETIC, so that the trays can be used in a variety of different locations. The individual chips are laid in rows on the trays the number depending on the tray dimensions and the chip size. the design of trays permits them to be stacked vertically without damage to the chips carried by each tray.

The trays are usually fabricated from a thermosetting synthetic polymer composition which contains inorganic fillers to improve dimensional and temperature stability. It is also necessary to include additives to increase electrical conductivity and ensure that electrostatic charges cannot build up when in use.

The present invention provides improved carrier trays, a composition for the manufacture of carrier trays and a method of manufacturing such trays.

According to the present invention there is provided a carrier tray comprising a synthetic resin composition

containing inorganic fillers and having a low electrical resistivity, characterised in that the resin is a thermosetting resin and the resistivity is low due to the presence of electrically conducting particles or fibres within the cured resin.

There is further provided a method of making carrier trays comprising mixing into a thermosetting resin containing inorganic fillers electrically conducting particles or fibres until they are uniformly distributed within the resin and filler composition, placing the mixture in a mould in the form of the tray and thereafter heating the mould under pressure until such time as the thermosetting mixture has set and thereafter removing the tray so formed from the mould.

The preferred thermosetting resins are unsaturated polyester resin compositions which are hardened or cured by organic peroxides. The hardening agents may be combined with inhibitors which prevent the hardening action until the resin composition is subjected to elevated temperatures. Compositions of this nature are available commercially, such as BMC 400 and BMC 700 supplied by Bulk Molding Compounds Incorporated of West Chicago, U. S. A. These compositions consist of an unsaturated polyester resin and inhibited curing agents with inorganic fillers, such as glass, which increase the physical strength of the moulded and cured material. Similar materials are available from from the companies Galastic and Plenco. For good physical stability the glass filler may be present as in the form of fibres and comprise from 10 to 20 percent by weight of the composition. As an alternative or addition carbon fibres may by included as fillers. Such fillers have an additional advantage of increasing the electrical conductivity of the cured material. Further fillers

include calcium carbonate

Other thermosetting resin compositions may be used such as amine and formaldehyde condensation polymers, e.g. those derived from urea, and melamine, phenol and formaldehyde condensation polymers, e.g. those derived from phenol, catechol and other phenolic compounds. Epoxy condensation polymers such as those derived from bisphenol A and similar phenols with amines and amides including polyamides. All such condensation polymers may include both electrically conducting and non-conducting fillers.

The resistivity, particularly the surface resistivity, of the cured resin must be low to prevent the accumulation or creation of static electric charges. Charges of this nature can catastrophically damage semiconductor devices. The resistivity of composition, which is inherently an insulator, can be lowered by the inclusion of electrically conducting fillers. Suitable fillers of this nature include the above mentioned carbon fibres, carbon black, metal fibres and metal coated fibres such as glass and polymer fibres coated with a thin metal layer by vacuum deposition, electroless plating and other known techniques. The conducting fibres can comprise from 2.5 to 7 percent by weight of the cured composition. Trays manufactured in accordance with this invention have a surface resistivity less than 1 megohm per square, preferably 500 kilohms per square or less, which ensures that the leads of semi-conductor integrated circuits touching the surface of the tray are all held at substantially the same potential. The difference in electrical potentials between leads cannot reach a level that would cause catastrophic breakdown of any of the circuit components within the device carried by the tray.

The incorporation of the fibres into the resin

composition prior to use may be carried out using conventional blending means. The blended composition is heated under pressure to cause the polyester composition to cross-link and form a rigid, filler reinforced, item.

In practical embodiments rectangular trays having a 315 mm major dimension and 136 mm minor dimension were moulded from a polyester compositions obtained from BMC Inc. One series of compositions contained 15 percent by weight glass fibres and 6 percent by weight carbon fibres. In other compositions the glass fibre content was reduced to 5 percent which improved the resistivity and thermal conductivity reducing the time for the moulding cycle.

Trays were formed in a mould by heating the composition under pressure to a temperature in the range 150 to 200 degrees Celcius. After moulding the trays were preferably subjected to a post-baking as this stabilised the dimensions and ensured very low change occurring in any subsequent high temperature conditions.

CLAIMS

1. A carrier tray comprising a synthetic resin composition containing inorganic fillers and having a low electrical resistivity, characterised in that the resin is a thermosetting resin and the surface resistivity is low due to the presence of electrically conducting particles or fibres within the cured resin.

2. The carrier tray as claimed in claim 1, characterised in that the thermosetting resin is an unsaturated polyester resin.

3. The carrier tray as claimed in claim 2, characterised in that the thermosetting resin is hardened or cured by the presence of an organic peroxides.

4. The carrier tray as claimed in claim 1 or claim 2, characterised in that the thermosetting resin composition contains a polymerisation inhibitor inactivated by heat.

5. The carrier tray as claimed in any of the preceding claims characterised in that the inorganic filler includes glass fibres, glass powder and/or calcium carbonate.

6. The carrier tray as claimed in any of the preceding claims, characterised in that the electrically conducting particles or fibres include one or more of carbon fibres, carbon black, metal fibres and metal coated fibres.

7. The carrier tray as claimed in any of the preceding claims, characterised in that the metal coated fibres comprise glass and/or polymer fibres coated with a thin metal layer by vacuum deposition, electroless plating or other known techniques.

8. The carrier tray as claimed in any of the preceding claims, characterised in that the conducting fibres comprise from 2.5 to 7 percent by weight of the cured composition.

9. The carrier tray as claimed in any of the preceding claims, characterised in that surface resistivity is less that 1 megohm per square, preferably less than 500 kilohms per square.

10 A method of making carrier trays comprising mixing into a thermosetting resin containing inorganic fillers electrically conducting particles or fibres until they are uniformly distributed within the resin and filler composition, placing the mixture in a mould in the form of the tray and thereafter heating the mould under pressure until such time as the thermosetting mixture has set and thereafter removing the tray so formed from the mould.